US 20020016188A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2002/0016188 A1

Kashiwamura (43) Pub. Date: Feb. 7, 2002

(54) WIRELESS TRANSCEIVER SET

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(21) Appl. No.: 09/886,619

(22) Filed: Jun. 22, 2001

(30) Foreign Application Priority Data

Jun. 22, 2000 (JP) 2000-187792
Feb. 26, 2001 (JP) 2001-050027

Publication Classification

(51) Int. Cl.[7] H04M 1/00

(52) U.S. Cl. 455/568; 455/569; 455/557

(57) ABSTRACT

This invention provides a wireless transceiver set for a cellular phone including a headset to be put on at a user's ear or head and an adapter unit which is to be connected to a cellular phone and which improves power saving during a stand-by mode in order to extend the life of battery therein longer. The headset includes a microphone, an earphone, a battery and a transceiver circuit to communicate through the adapter unit with a radio frequency. The adapter unit of the wireless transceiver set includes a battery, a transceiver circuit, detection means for periodically detect a radio frequency from the head set, and switch means for cutting off electric power supply from a battery to the circuit in the adapter unit when no radio frequency from the headset is detected. The invention also provides a wireless transceiver set for a stationary phone or a personal digital assistance including a headset to be put on at a user's ear so that a user can communicate over the standard phone or the PDA with hand-free condition.

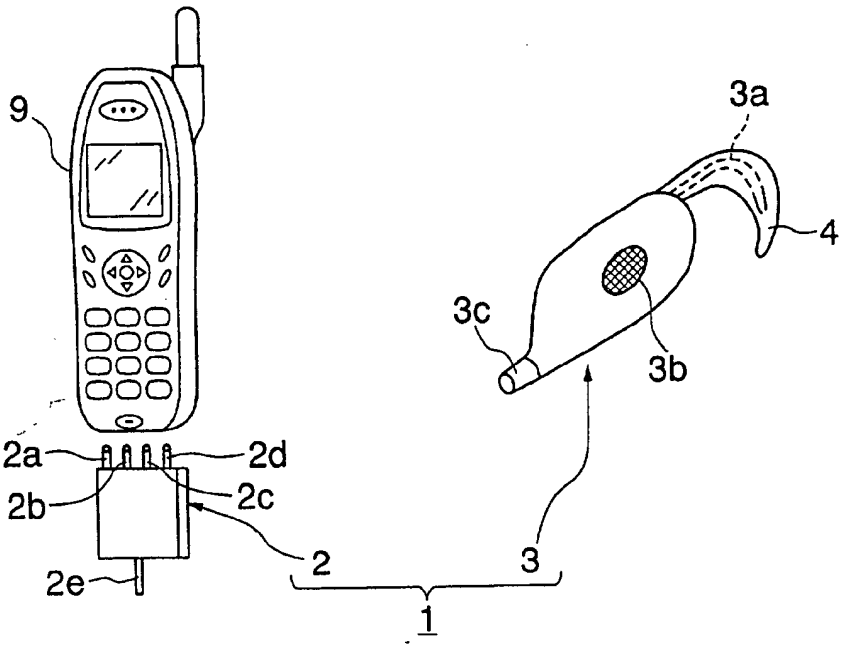


FIG. 1

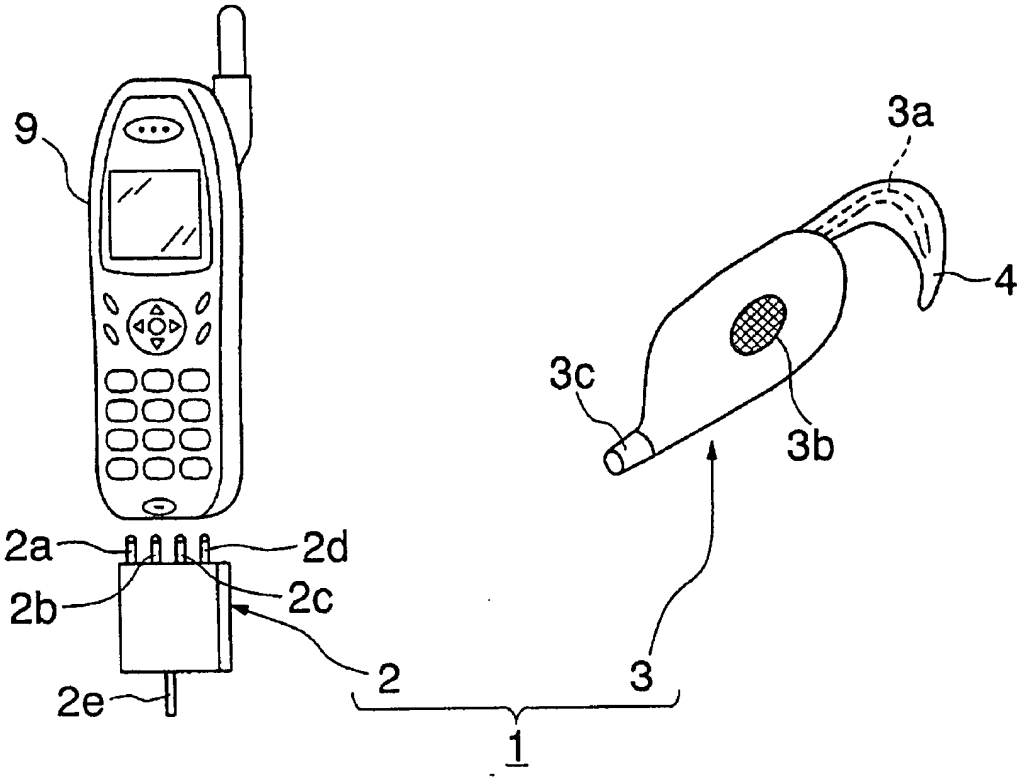


FIG. 2

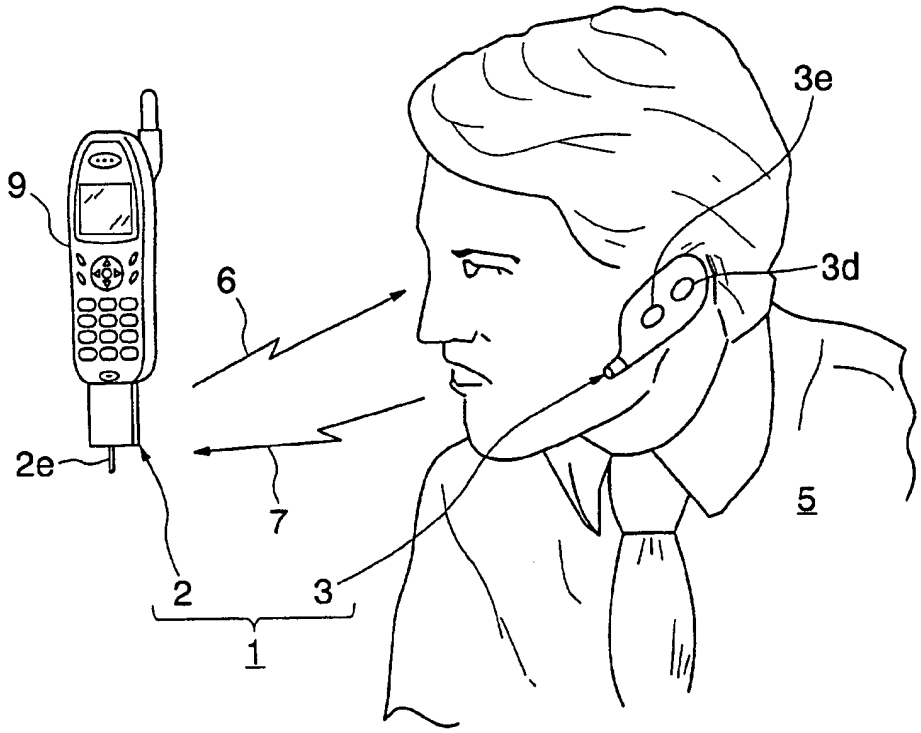


FIG. 3

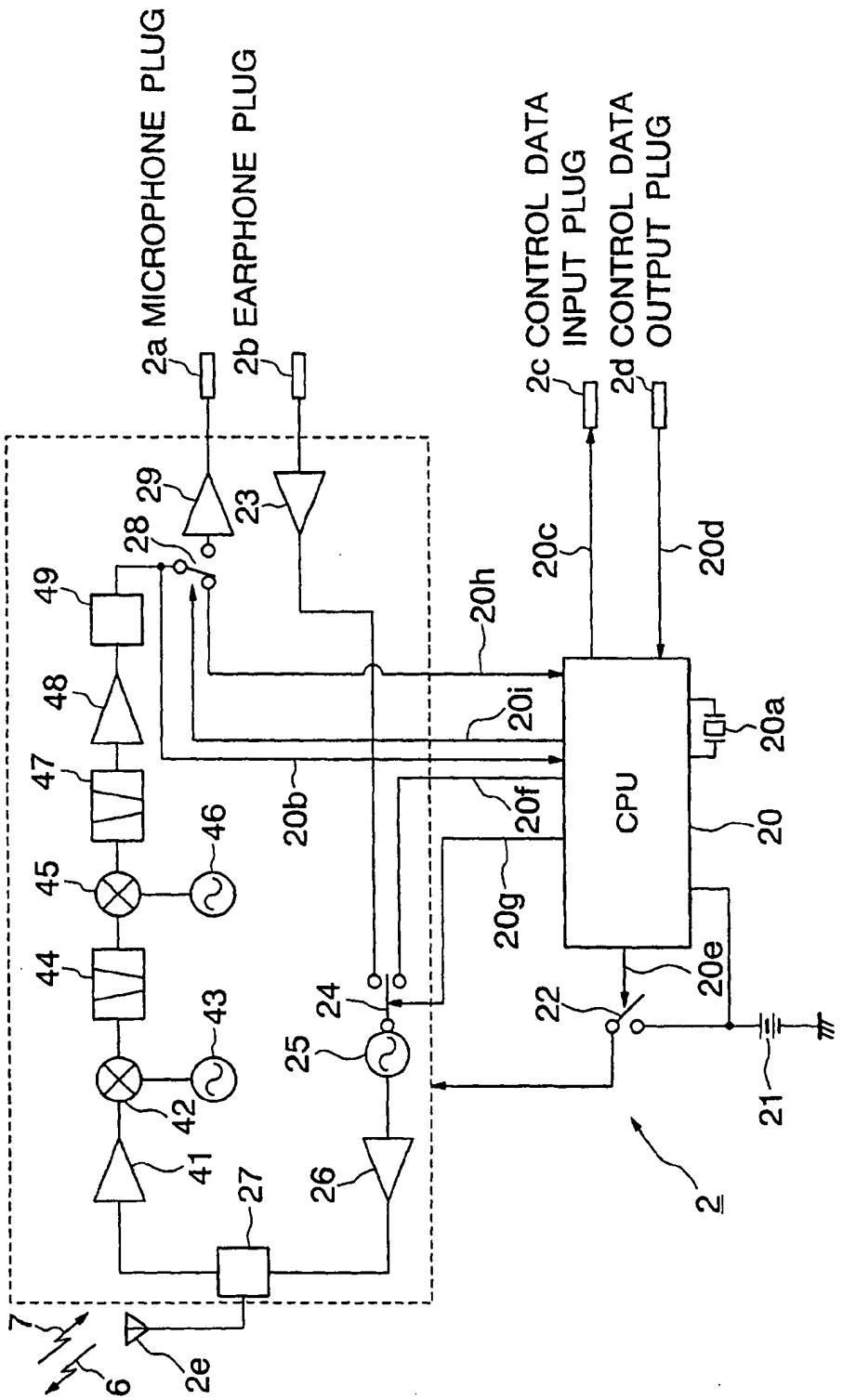

2a MICROPHONE PLUG
2b EARPHONE PLUG
2c CONTROL DATA INPUT PLUG
2d CONTROL DATA OUTPUT PLUG
CPU
20
20a
20b
20c
20d
20e
20f
20g
20h
20i
21
22
23
24
25
26
27
28
29
41
42
43
44
45
46
47
48
49
2
6
7
2e

FIG. 4

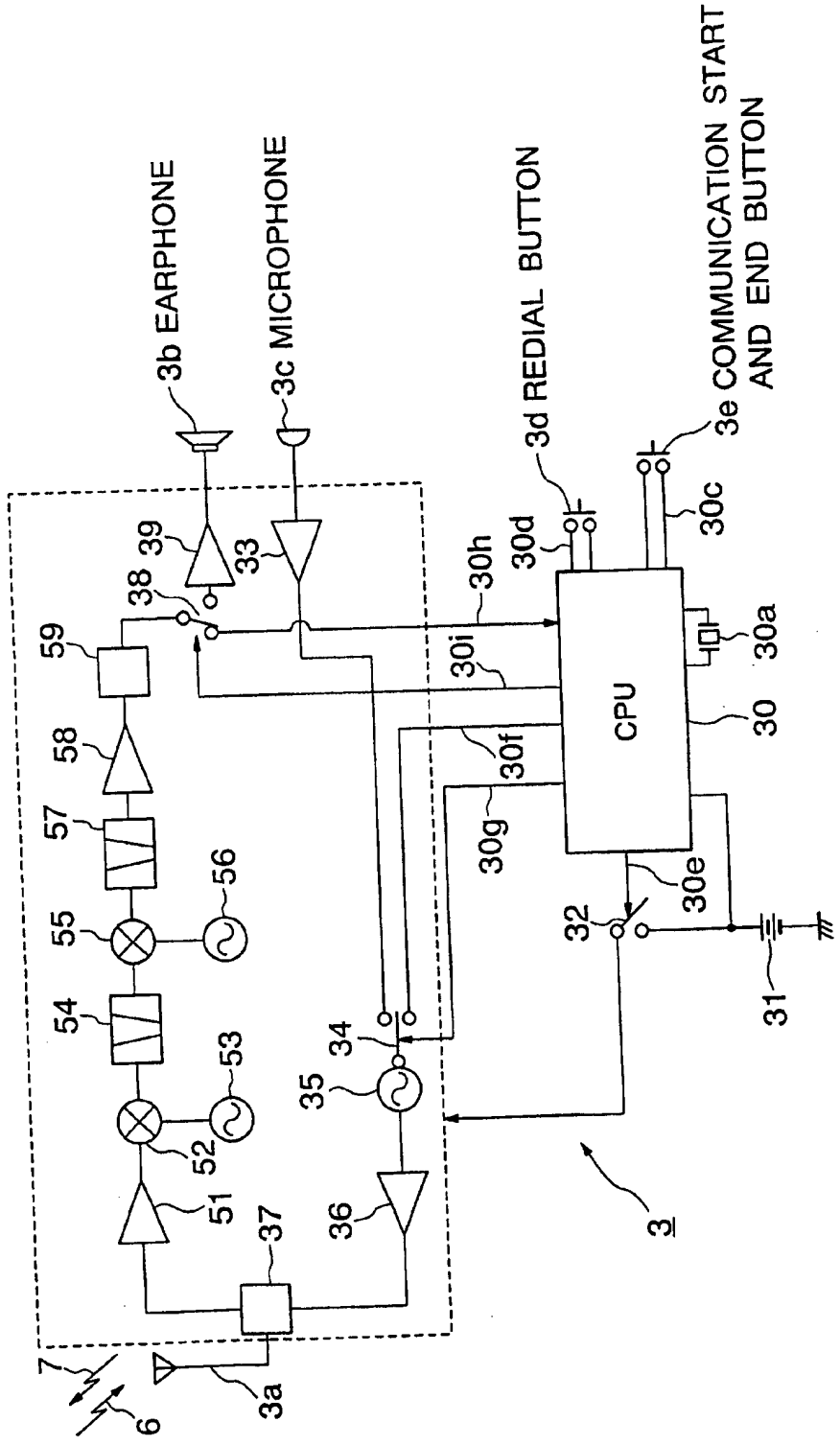

3b EARPHONE
3c MICROPHONE
3d REDIAL BUTTON
3e COMMUNICATION START AND END BUTTON
CPU
30
30a
30c
30d
30e
30f
30g
30h
30i
31
32
33
34
35
36
37
38
39
51
52
53
54
55
56
57
58
59
3
3a
6
7

FIG. 5A

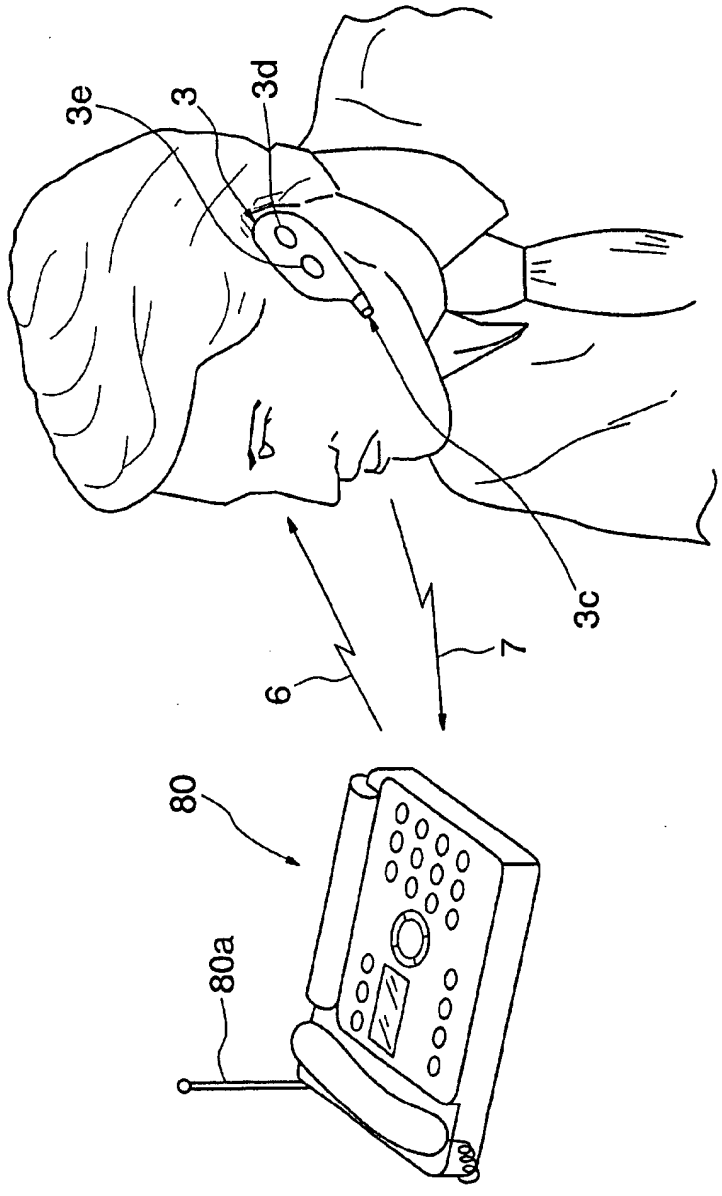


FIG. 5B

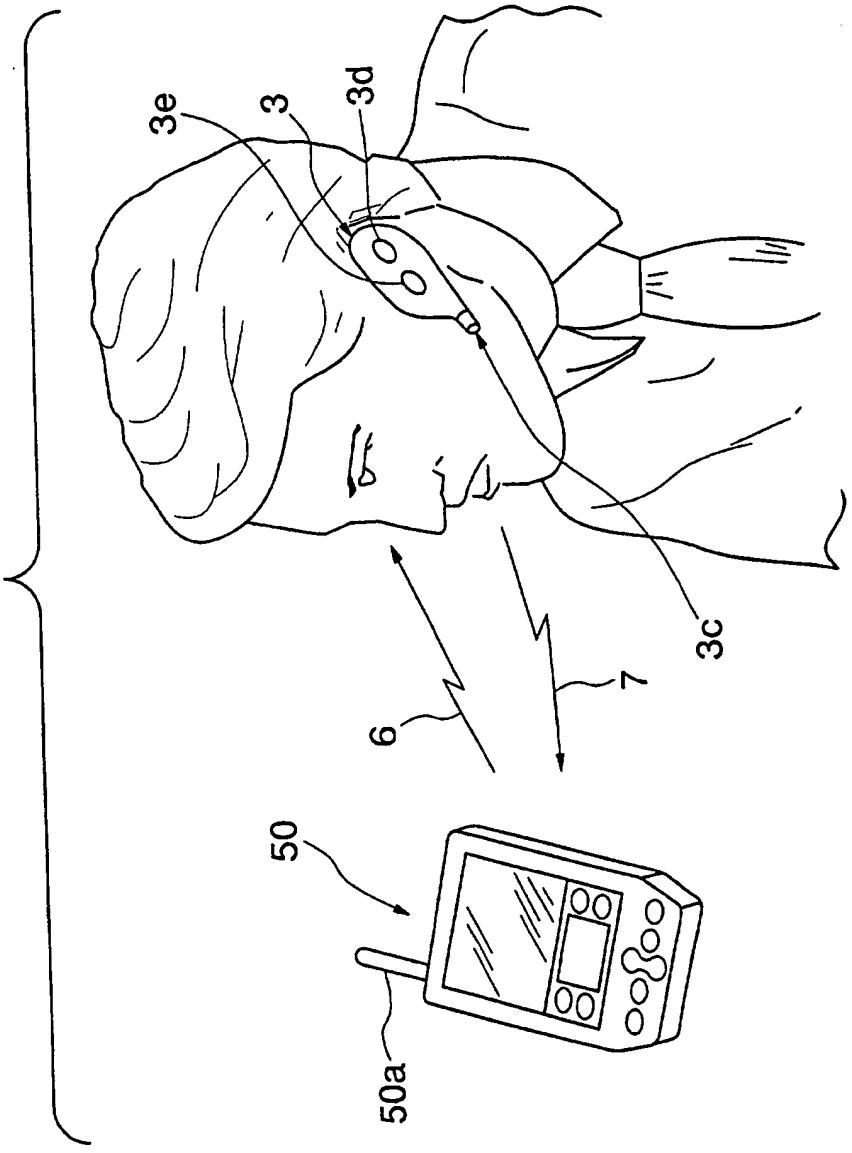


FIG. 6

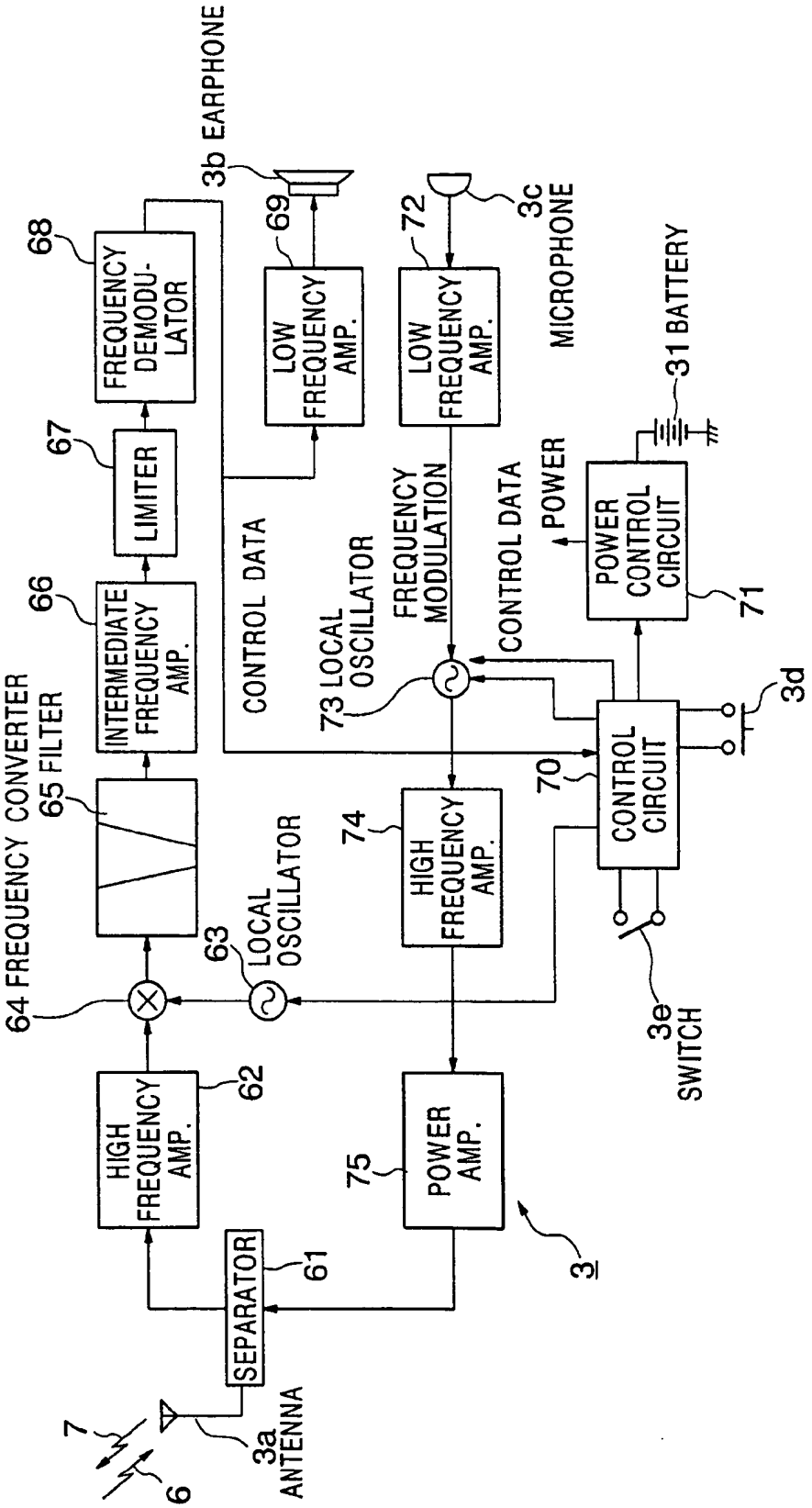
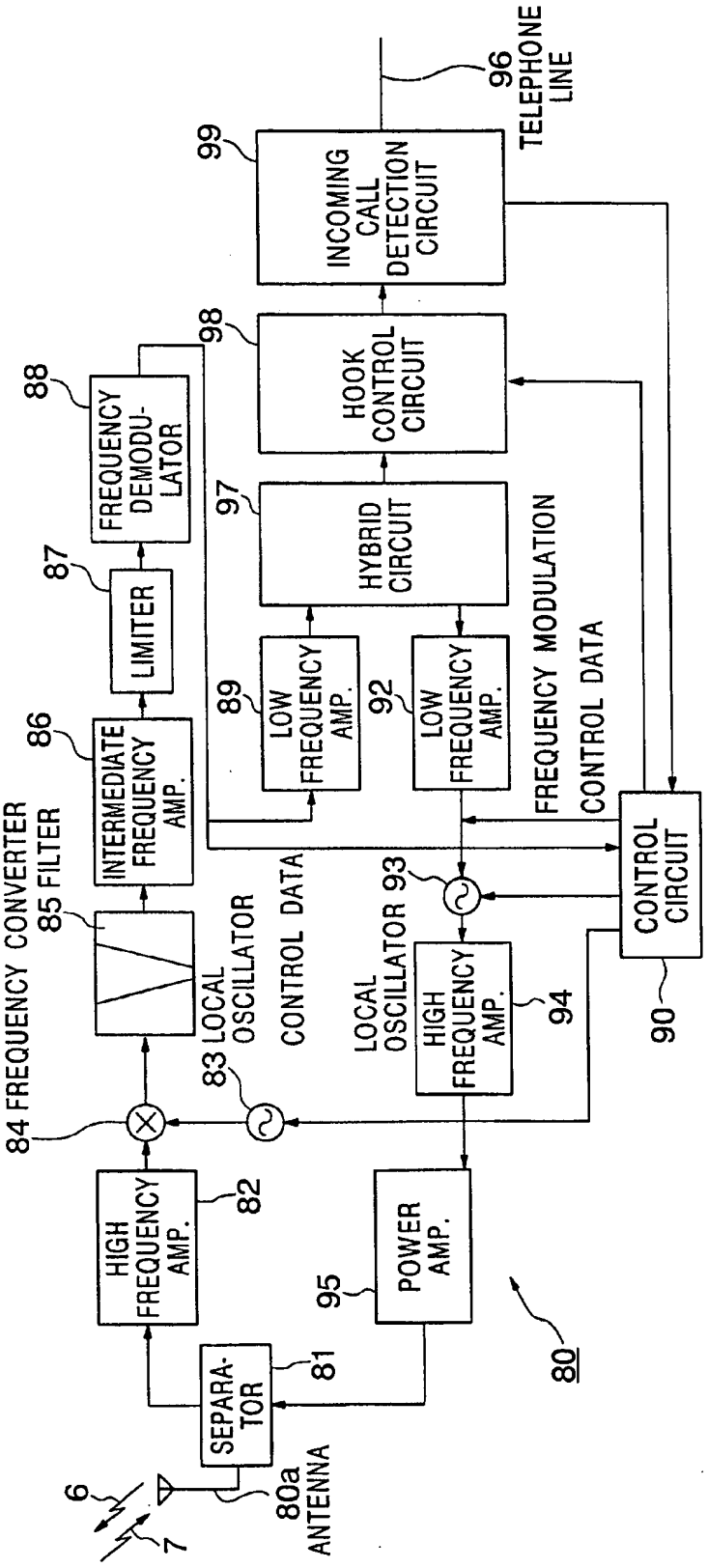

3b EARPHONE
68
FREQUENCY DEMODU-LATOR
69
LOW FREQUENCY AMP.
72
LOW FREQUENCY AMP.
3c MICROPHONE
31 BATTERY
67
LIMITER
66
INTERMEDIATE FREQUENCY AMP.
CONTROL DATA
FREQUENCY MODULATION
CONTROL DATA
POWER
POWER CONTROL CIRCUIT
71
73 LOCAL OSCILLATOR
3d
64 FREQUENCY CONVERTER
65 FILTER
70
CONTROL CIRCUIT
74
HIGH FREQUENCY AMP.
63 LOCAL OSCILLATOR
3e SWITCH
62
HIGH FREQUENCY AMP.
75
POWER AMP.
3
61
SEPARATOR
7
6
3a ANTENNA

FIG. 7


6
7
80a
ANTENNA
SEPARA-
TOR
81
HIGH
FREQUENCY
AMP.
82
84 FREQUENCY CONVERTER
85 FILTER
83 LOCAL
OSCILLATOR
CONTROL DATA
INTERMEDIATE
FREQUENCY
AMP.
86
LIMITER
87
FREQUENCY
DEMODU-
LATOR
88
LOW
FREQUENCY
AMP.
89
LOCAL
OSCILLATOR 93
HIGH
FREQUENCY
AMP.
94
POWER
AMP.
95
80
LOW
FREQUENCY
AMP.
92
FREQUENCY MODULATION
CONTROL DATA
HYBRID
CIRCUIT
97
HOOK
CONTROL
CIRCUIT
98
INCOMING
CALL
DETECTION
CIRCUIT
99
CONTROL
CIRCUIT
90
96
TELEPHONE
LINE

WIRELESS TRANSCEIVER SET

FIELD OF THE INVENTION

[0001] This invention generally relates to a wireless transceiver set, and, in particular, to a wireless transceiver set including a headset including a microphone, an earphone, a battery and a transceiver circuit therein and to be put on at a user's ear or head.

BACKGROUND OF THE INVENTION

[0002] There is a prior art transceiver including a headset which is put on at a user's ear or head and in which a microphone and an earphone are incorporated. But, the prior art headset has a wire in order to connect with the transceiver so that electric signals from a microphone and to an earphone of the headset can be conveyed through the wire to and from the transceiver. Such a headset is called as hand-free set since a user can use his or her hands when taking over the transceiver by using such a headset. Such a headset is though to be convenient to use with a cellular phone during, for example, driving a car, since a user can put his or her hands on a steering wheel while talking over the cellular phone. However, the wire of such a headset is cumbersome and limits user's activity. Such a headset can only be used when a user is sitting or moving a limited range where the wire of such a headset can reach.

[0003] On the other hand, a cellular phone is widely used to have access to the Internet nowadays. Having access to the Internet with a cellular phone, a user watches contents displayed on a small monitor provided on a cellular phone and controls the access to the Internet by pushing buttons provided on a cellular phone with user's fingers. Accordingly, a microphone and a speaker provided on such a cellular phone are far from a user's mouse and ears. Consequently, a user must increase the volume of the speaker of the cellular phone and speak loudly to the microphone of the cellular phone. This would disturb people around a user.

[0004] In addition, a personal digital assistance (PDA) has capability to be used as cellular phone or to have access to the Internet. In this case, a microphone and a speaker are necessary for PDA.

[0005] There is a conventional wireless transceiver, such as, a child unit of a stationary phone to talk to a person connected over the stationary phone (a parent unit) through a radio frequency. Although such a child unit of a stationary phone is small, such a child unit is not so small as a headset to be put on at a user's ear or head.

[0006] If a wireless transceiver of headset type is used with a cellular phone, a stationary phone, or a PDA, the cumbersome wire would be eliminated and a user would be able to move freely with hand-free condition. In addition, a user would listen to sound or music from a cellular phone, a stationary phone, or a PDA and speak over a cellular phone, a stationary phone, or a PDA without disturbing others around a user with loud sound or speech. In addition, while watching contents displayed on the screen of small monitor of a cellular phone or a PDA as well as listening to sound through the Internet, a user can control access to the Internet by pushing small buttons or using pen on a cellular phone or a PDA. Moreover, with a wireless transceiver, there is no need to provide additional speaker and microphone on a PDA.

[0007] The wireless transceiver set comprises two units. One of which is a wireless headset to be put on at a user's ear or head, including all components of wireless transceiver including a microphone and an earphone for sending and receiving radio frequency signals. The other of which is an adapter unit directly connected to a cellular phone, PDA, or a stationary phone and including all components of transceiver for sending and receiving radio frequency signals to and from the wireless headset. Since a cellular phone or PDA is getting smaller and lighter, such a wireless transceiver set, including a headset and an adapter unit, to be used with a cellular phone or PDA should be much smaller and lighter than a cellular phone or PDA in order to be suitable for a cellular phone or PDA. Above all, the smaller and lighter a headset is, the more comfortably be a headset put on at a user's ear and head.

[0008] Therefore, a battery for a headset which is the largest and heaviest electric component in the headset should be small and light. Consequently, power saving for a battery of a headset is critical so that a wireless transceiver can be used for a reasonable period of time without replacing a battery. As for power source for an adapter unit, power source of a cellular phone, a stationary phone, or PDA might be used instead of a battery since an adapter unit is directly connected to a cellular phone, a stationary phone or a PDA. But, since each of cellular phone, stationary phone, or PDA has a different design to have its power source connect to an outside adapter unit, a battery is still a preferable power source for an adapter unit in order to avoid various design changes for an adapter unit to be connected to the power source of a cellular phone, a stationary phone, or a PDA. An adapter unit might be able to use a larger and heavier battery than a headset since an adapter unit is not put on at a user's ear or head but directly connected to a cellular phone, a stationary phone, or a PDA. A smaller and lighter power cell is, however, also preferable for an adapter unit since it would make an adapter unit smaller and lighter and less costly.

[0009] For example, a battery of small button type of which power capacity is very small (for example, the power capacity of 3 volt and 210 milliamperehour) is preferably used for power source of both headset and adapter unit in order to make a headset and an adapter unit appropriate size and weight with appropriate cost.

[0010] Accordingly, power saving for such a wireless transceiver set including a headset and an adapter unit during a stand-by mode and a communication mode is very critical so that a wireless transceiver set can be used for a reasonable period of time without replacing their small and light battery.

[0011] Particularly, power saving during a stand-by mode of a wireless transceiver set is more important since a stand-by mode is much longer than a communication mode of such a wireless transceiver set.

SUMMARY OF THE INVENTION

[0012] One of the objects of the present invention is to improve power saving during a stand-by mode in a wireless transceiver set including a headset and an adapter unit in order to keep the wireless transceiver set alive for a reasonable period of time without replacing of a battery of small capacity in a headset and an adapter unit.

[0013] According to the present invention, there is provided a wireless transceiver set including an adapter unit adapted to be connected to a cellular phone and a headset adapted to be put on at a user's head portion, comprising: the adapter unit including a first CPU, a first battery, a first transceiver means for sending and receiving sound and control signals from and to the adapter unit through a radio frequency, a detection means for periodically detecting a radio frequency from the headset, and a first power switching means for supplying the adapter unit with electric power from the first battery when the detection means detects the radio frequency from the headset and for cutting off the electric power from the first battery when the detection means does not detect any radio frequency from the had set, and the headset including a second CPU, a second battery, a second transceiver means for sending and receiving sound and control signals from and to the headset through a radio frequency, and a second power switching means for supplying the headset with electric power from the second battery and for cutting off the electric power from the second battery in order to start and end communication through the adapter unit.

[0014] The first and second batteries may be a lithium battery of button type having the power capacity of 3 volts and 210 milliampere-hour. Alternatively, the first and second batteries may be a rechargeable battery. The detection means may periodically, for example, once every a few seconds, detect a radio frequency from the headset for a certain period of time, for example, 100 milliseconds. The first and second CPU may have means for translating protocols between the control information of the wireless transceiver set and the control information of the cellular phone.

[0015] In operation, during a sand-by mode, the adapter unit periodically check whether or not a radio frequency is received from the headset by detection means. If a radio frequency received from the headset is detected, the adapter unit continues to supply the adapter unit with electric power from the first battery by the first power switching means for communication between the headset and the cellular phone. If a radio frequency received from the headset is not detected, the adapter unit cuts off the electric power from the first battery to the transceiver means thereof by the first power switching means. Therefore, the adapter unit can save power consumption during a stand-by mode of the adapter unit in order to keep the first battery of the adapter unit alive for a longer period time. By choosing appropriate period of time for checking a radio frequency from a head set, the adapter unit would be able to respond to the radio frequency from a headset to establish the communication between the headset and the cellular phone through the adapter unit without significant delay. On the other hand, the headset controls the power saving by the second power switching means which switches manually on and off electric power from the second battery in the headset to the transceiver means thereof when communication over the cellular phone through the adapter unit starts and ends. Therefore, the headset can save power during unused mode of the headset in order to keep the second battery of the headset alive for a longer period time.

[0016] In another aspect of the present invention, there is provided a child unit of a stationary phone adapted to communicate over the stationary phone through a radio frequency, comprising: a headset adapted to be put on at a user's ear and including a microphone, an earphone, a battery therein, a transceiver means for sending and receiving sound signals to and from the stationary phone through a radio frequency, and a switch means for switching on and off electric power supply to the transceiver means from the battery in order to start or end communication over the stationary phone.

[0017] With the child unit of the invention, a user can talk over a stationary phone while walking freely around the stationary phone with hand-free condition.

[0018] In another aspect of the present invention, there is provided a wireless transceiver set for a personal digital assistance (PDA) to communicate over the personal digital assistance through a radio frequency, comprising: a headset adapted to be put on at a user's ear and including a microphone, an earphone, a battery therein, a transceiver means for sending and receiving sound signal through a radio frequency, and a switch means for switching on and off electric power supply to the transceiver means from the battery in order to start or end communication over the personal digital assistance.

[0019] With the wireless transceiver set of the invention, a user can talk over a personal digital assistance or listen to music over a personal digital assistance while watching contents displayed on a small display screen of the personal digital assistance through the Internet with hand-free condition.

[0020] These and other advantages will be apparent to those of ordinary skill in the art having reference to the specification in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In the drawings:

[0022] **FIG. 1** shows a schematic diagram of a wireless transceiver set of a preferred embodiment in accordance with the invention;

[0023] **FIG. 2** shows a schematic diagram of a wireless transceiver set shown in **FIG. 1** in use condition;

[0024] **FIG. 3** shows a block diagram of a circuit of an adapter unit to be connected to a cellular phone of a wireless transceiver set of a preferred embodiment in accordance with invention;

[0025] **FIG. 4** shows a block diagram of a circuit of a headset to be put on at a user's head of a wireless transceiver set of a preferred embodiment in accordance with invention;

[0026] **FIG. 5A** shows a schematic diagram of a wireless transceiver set of another embodiment of the invention in use condition;

[0027] **FIG. 5B** shows a schematic diagram of a wireless transceiver set of still another embodiment of the invention in use condition;

[0028] **FIG. 6** shows a block diagram of a circuit of a headset of a wireless transceiver set shown in **FIGS. 5A and 5B** to be put on at a user's head; and

[0029] **FIG. 7** shows a block diagram of a circuit for use in a stationary phone shown in **FIG. 5A**.

[0030] In the drawings, the same or similar numerals are used to indicate the same, similar or corresponding parts or elements.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0031] **FIG. 1** shows a wireless transceiver set **1** of the first embodiment of the invention for a cellular phone. The wireless transceiver set **1** for a cellular phone includes an adapter unit **2** adapted to be connected to external connector (not shown) provided at the bottom of a cellular phone **9** of off-the-shelf type and a headset **3** adapted to be put on at a user's ear. The adapter unit **2** has a microphone plug **2***a*, an earphone plug **2***b*, a control data input plug **2***c*, and a control data output plug **2***d* which are provided at one end of the adapter unit and are adapted to be inserted into the external connector (not shown) provided at the bottom of the cellular phone **9**. The adapter unit **2** also has an antenna **2***e* at the other end.

[0032] The headset **3** has an attachment member **4** at one end which is to be put on at a user's ear and has a shape like a hook of glasses. This attachment **4** may have an antenna **3***a* embedded in. The headset **3** also has an earphone **3***b* at a center portion of the headset **3** facing an ear of a user. The headset **3** has a microphone **3***c* at the other end opposite to the attachment **4**.

[0033] **FIG. 2** shows the wireless transceiver set **1** in use condition in which the adapter unit **2** is connected to the external connector (not shown) at the bottom of a cellular phone **9** and the headset **3** is put on at a user's **5** ear (not shown). The headset **3** has a communication start and end switch button **3***e* and redial switch button **3***d* provided on the other surface opposite to the earphone **3***b* so that a user **5** can push the buttons **3***e* and **3***d*. The microphone **3***c* of the headset **3** is located near the mouth of a user **5** when the headset **3** is put on at a user's ear.

[0034] The adapter unit **2** of the wireless transceiver set **1** can send sound signals received from the cellular phone **9** to the headset **3** with a frequency modulated radio frequency **6** at 314 MHz. The headset **3** of the wireless transceiver set **1** can send sound signals from a user **5** to the adapter unit **2** with a frequency modulated radio frequency **7** at 223 MHz. In addition, the adapter unit **2** can send control data output signal from the cellular phone **9** to the headset **3** with the frequency modulated radio frequency **6**. The headset **3** can send control data input signal from the headset **3** to the cellular phone **9** through the adapter unit **2** with the frequency modulated radio frequency **7**.

[0035] The output power of transmission of radio frequency **6** from the adapter unit **2** is about 0.001 milliwatt. The output power of transmission of radio frequency **7** from the headset **3** is about 0.001 milliwatt. This transmission output power is large enough to establish communication between the adapter unit **2** and the headset **3** if the adapter unit **2** and the headset **3** are located within 3 meter distance.

[0036] **FIG. 3** shows a block diagram of a circuit of the adapter unit **2** according to a preferred embodiment of the invention. The adapter unit **2** includes a CPU **20** and a battery **21**, for example, a lithium button battery of consumption type (Type No.CR2032A). The CPU **20** has a CPU clock **20***a* and is directly connected to the battery **21**. The battery **21** also supplies electric power to all over the adapter unit **2** including a transceiver circuit of the adapter unit **2** through a switch **22**. The battery **21** has the capacity of 3 volt and 210 milliampere-hour. Therefore, in order to assure a continuous 10 hour communication time with this battery **21**, it is necessary for the adapter unit **2** to keep the overall current in a communication mode is less than 20 milliampere, that is, to keep overall power consumption in a communication mode is less than 60 milliwatt, and to supply the adapter unit **2** with the rest of electric power, 10 milliampere-hour, for overall stand-by mode of the adapter unit **2**.

[0037] The CPU **20** is connected to a control data input plug **2***c* and a control data output plug **2***d* through lines **20***c* and **20***d*, respectively. When the control data input plug **2***c* and the control data output plug **2***d* are plugged into the external connector (not shown) provided at the bottom of the cellular phone **9**, a switch means (not shown) in the CPU **20** becomes on-condition in order to reset the CPU **20**, and then to start a CPU clock **20***a*, and then to set the adapter unit **2** in a stand-by mode. When the adapter unit **2** is removed from the bottom of the cellular phone **9**, the control data input plug **2***c* and the control data output plug **2***d* of the adapter unit **2** are also detached from the cellular phone **9**. Therefore, the switch means (not shown) in the CPU **20** becomes off-condition, the CPU **20** sets the adapter unit **2** in an unused condition from a stand-by mode. In the unused condition, all circuit but the CPU **20** of the adapter unit **2** is cut off from the battery **21** and is not supplied with electric current from the battery **21**.

[0038] In a stand-by mode, a line **20***b* from the receiver circuit of the adapter unit **2** is connected to the CPU **20** in order to detect if there is a radio frequency **7** received from the headset **3**. The CPU **20** is programmed to periodically, for example, once every 2 seconds, makes a switch **22** on-condition through a line **20***e* for a certain period, for example, 100 milliseconds, and supplies transceiver circuit including the receiver and transmission circuits of the adapter unit **2** with electric power from the battery **21** so as to check whether or not there is a radio frequency **7** received from the headset **3**. If the CPU **20** detects a radio frequency **7** received from the headset **3** through the line **20***b*, the CPU **20** keeps the switch **22** on-condition and keeps the adapter unit **2** in a communication mode. The overall power consumption of the adapter unit **2** in a communication mode is held less than 60 milliwatt.

[0039] If the CPU **20** does not detect any radio frequency **7** from the headset **3** through the line **20***b*, then the CPU **20** cut off the switch **22** through the line **20***e* and stops the power supply from the battery **21** to the transceiver circuit including the receiver and transmission circuits of the adapter unit **2**. And then, the CPU **20** continues the same procedure as explained before during a stand-by mode. During a stand-by mode as well as unused mode, the CPU **20** is always supplied with electric power from the battery **21**, the power consumption by the CPU **20** is very small and less than or at most equal to the leakage current from the battery **21** since the CPU **20** is made by CMOS technology. Therefore, this power consumption by the CPU **20** is almost negligible in the unused mode. In a stand-by mode, the adapter unit **2** periodically supplies the transceiver circuit thereof with electric power from the battery **21** to check if there is a radio frequency **7** received from a headset **3**, for

example, once every 2 seconds for 100 milliseconds. By using such a periodical check, the power consumption in a stand-by mode of the adapter unit **2** per hour can be reduced to as low as one two hundredth (1/200) of power consumption for a communication mode of the adapter unit **2** per hour. As a result, the 10 milliampere-hour power capacity of the battery **21** can keep the adapter unit alive in a stand-by mode for about 100 hours.

[0040] The CPU **20** converts the protocols of control data from the cellular phone **9** via the plug **2***d* and the line **20***d* into the protocols for the wireless transceiver **1** and then the CPU **20** outputs the control data converted for the wireless transceiver **1** on a line **20***f* to send to the headset **3**. The adapter unit **2** can send sound signal output from the cellular phone **9** through an earphone plug **2***b* and an amplifier **23** or the control data on the line **20***f* from the cellular phone **9** to the headset **3** by switching a switch **24** via a line **20***g* by the CPU **20**. The transmission circut of the transceiver circuit of the adapter unit **2** includes a phase locked loop (PLL) **25**, an amplifier **26**, a separation circuit **27** in order to send sound and control data signals from the cellular phone **9** via an antenna **2***e* to the headset **2** with a frequency modulated radio frequency **6**.

[0041] The CPU **20** converts the protocols (procedures) between the control data from outside connectors (not shown) at the bottom of the cellular phone **9** and the control data of the wireless transceiver set **1** of the invention. By using this protocol conversion, not only sound signal but also control data can be transferred between the cellular phone **9** and the wireless transceiver set **1**. The control data transferred between the cellular phone **9** and the wireless transceiver set **1** includes, such as, control data for starting and ending communication over the cellular phone **9** and dial number data.

[0042] The CPU **20** converts the protocols of control data received from the headset **3** and output the converted protocol of the control data on the line **20***c* in order to send to the cellular phone **9** through the control data input plug **2***c*. The adapter unit **2** can input sound signal received from the headset **3** through a frequency modulated radio frequency **7** into the cellular phone **9** via an amplifier **29** and a micro-phone plug **2***a* and control data received from the headset **3** through a frequency modulated radio frequency **7** into the cellular phone **9** via the line **20***h*, the CPU **20** for protocol conversion, the line **20***c* and the plug **2***c* by switching a switch **28** via a line **20***i* by the CPU **20**.

[0043] The receiver circuit of the transceiver circuit of the adapter unit **2** further includes amplifiers **41** and **48**, mixers **42** and **45**, PLLs **43** and **46**, filters **44** and **47**, and a demodulation circuit **49** for demodulating and amplifying a frequency modulated radio frequency **7** received from the separation circuit **27** and the antenna **2***e*.

[0044] **FIG. 4** shows a block diagram of circuit of the headset **3** according to an embodiment of the invention. The headset **3** includes a CPU **30** and a battery **31**, for example, a lithium button battery of consumption type (Type No.CR2032A). The CPU **30** has a CPU clock **30***a* and is directly connected to a battery **31**. The battery **31** also supplies electric power to all circuits in the headset **3** including a transceiver circuit of the headset **3** through a switch **32**. The battery **31** has the capacity of 3 volt and 210 milliampere-hour. Therefore, in order to assure a continuous **10** hour communication time with this battery **31**, it is necessary for the headset **3** to keep the overall power consumption in a communication mode is less than 60 milliwatt.

[0045] The CPU **30** is connected to a communication start and end switch **3***e* through a line **30***c* and a redial switch **3***d* through lines **30***d*, respectively. A user picks the headset **3** up and put on the headset **3** at a his/her ear when he/she hears a ring or telephone call from the cellular phone **9** informing the user of an incoming call. When a user pushes the communication start and end switch **3***e*, a switch means (not shown) in the CPU **30** becomes on-condition in order to reset the CPU **30**, and then to start a CPU clock **30***a*, and then to make a switch **32** on-condition through a line **30***e*. Electric power from the battery **31** is supplied to the overall transceiver circuit of the headset **3** and the headset **3** is set in a communication mode in order to send a radio frequency **7** from the headset.

[0046] As explained in the above, the adapter unit **2** periodically checks if there is a radio frequency **7** from the headset **3**, for example, once every 2 seconds for 100 milliseconds. If the adapter unit **2** receives a radio frequency **7** from the headset **3**, the adapter unit **2** supplies electric power from the battery **21** to all circuits in the adapter unit **2** in order to change the adapter unit **2** from a stand-by mode to a communication mode.

[0047] When the adapter unit **2** is changed from a stand-by mode to a communication mode and receives control data indicating the start of communication from the headset **3** generated by pushing the communication start and end button **3***e* of the headset **3**, the CPU **20** of the adapter unit **2** converts the protocol of the control data indicating the start of communication as explained in the above to the protocols for the cellular phone **9** in order to make the cellular phone **9** in a communication mode, that is, a hook-up condition.

[0048] In a communication mode, the headset **3** sends sound signals of the user's speech from a microphone **3***c* to the adapter unit **2** via an amplifier **33**, a switch **34**, a PLL **35**, an amplifier **36**, a separation circuit **37** and an antenna **3***a* with a frequency modulated radio frequency **7**.

[0049] When communication is over, the user **5** pushes the communication start and end button **3***e* again. Then, control data indicating communication end is sent from the headset **3** to the adapter unit **2** and the CPU **30** makes the switch **32** off-condition through the line **30***e*. The headset **3** cuts off the electric power supply to the transceiver circuit of the headset **3** in order to stop sending a radio frequency **7** to the adapter unit **2**. Receiving the control data from the headset **3** generated by pushing the communication start and end button **3***e* again, the adapter unit **2** converts the protocols of the control data as explained in the above to the protocol of the cellular phone **9** in order to instruct the cellular phone **9** to end the communication mode, that is, to make the cellular phone hang-up condition.

[0050] Then, the adapter unit **2** returns to a stand-by mode to periodically check if there is a radio frequency **7** from the headset **3** again as explained before. If there is no radio frequency **7** from the headset **3**, the adapter unit **2** makes the switch **22** off-condition to stop electric power supply to the transceiver circuit of the adapter unit **2**.

[0051] The headset **3** keeps the power consumption in a communication mode less than 60 milliwatt and virtually

zero in a nonuse condition so that the headset **3** can make a 10 hour continuous communication time available with the battery **31** of the above-explained capacity.

[0052] If a user **5** pushes the redial switch **3***d*, the CPU **30** of the headset **3** outputs control data on a line **30***f* to instruct the cellular phone **9** to dial with a dial number of the latest call which is stored in a memory of the cellular phone **9**. The CPU **30** controls a switch **34** through a line **30***g* to connect to the line **30***f* in order to send the control data on the line **30***f* to the cellular phone **9** with a frequency modulated radio frequency **7**. The adapter unit **2** receives the control data sent from the headset **3** through a frequency modulated frequency **7** and then the CPU **20** converts the protocols of the received control data to the protocols of the cellular phone **9** in order to send the control data to the cellular phone **9** through the control data input plug **2***c*. The control data converted into the protocols of the cellular phone **9** instructs the cellular phone **9** to redial with the dial number of the latest call stored in a memory of the cellular phone **9**. If the cellular phone **9** is connected to the redialed number, the headset **3** is in a communication mode over the cellular phone with the adapter unit **2**. When the communication is over, the communication start and end button **3***e* is pushed to make the cellular phone **9** hang-up condition. Additionally, the redial switch **3***d* of the headset **3** may be able to make a call with dial numbers other than the latest call.

[0053] The CPU **30** can receive control data through **30***h* from the cellular phone **9** which is converted by the adapter unit **2** for the protocols of the wireless transceiver set **1**. The headset **3** outputs sound signals from the cellular phone **9** with a radio frequency **6** to a user's ear through an earphone **3***b* and an amplifier **39** or control data from the cellular phone **9** with a radio frequency **6** to the CPU **30** through the line **30***h*. The control data from the cellular phone **9** includes, such as, control data indicating a ring of incoming call and communication start and end. The control data received by the CPU **30** can be used to control the circuit of the head set **3**. For example, the control data indicating a ring of incoming call may automatically set the CPU **30** of the headset **3** in a communication mode. The receiver circuit of the transceiver circuit of the headset **3** includes amplifiers **51** and **58**, mixers **52** and **55**, PLLs **53** and **56**, filters **54** and **57**, and a demodulation circuit **59** for demodulating and amplifying a frequency modulated radio frequency **6** received from the antenna **3***a* and the separation circuit **37**.

[0054] In operation, an wireless transceiver set **1** for a cellular phone **9** according to the invention have its adapter unit **2** attached to the external connector of a cellular phone **9** and have its headset **3** in a pocket of clothes which a user is wearing. When the user hears a ring indicating an incoming call from the cellular phone **9**, he/she puts on the headset **3** at his/her ear and pushes a communication start and end button **3***e* to start communication over the cellular phone **9**. In order to end the communication, the user pushes the communication start and end button **3***e* again.

[0055] If a user wants to talk over the cellular phone **9** to the latest caller, he/she can push the redial button **3***d* to make a call.

[0056] Even if a cellular phone **9** is stored in a briefcase or put on a seat aside in a car, a user can make a call over the cellular phone without holding the cellular phone in hand. Therefore, the wireless transceiver set **1** of the invention is very convenient.

[0057] According to the wireless transceiver set **1** of the present invention, the adapter unit **2** attached to a cellular phone periodically, for example, every 2 seconds, supplies the transceiver circuit of the adapter unit **2** with electric power from the battery **21** for a predetermined period, for example, 100 milliseconds, in order to check if there is a radio frequency **7** from the headset **3**. If the adapter unit **2** detects a radio frequency **7** from the head set **3**, the adapter unit **2** continues to supply the transceiver circuit of the adapter unit **2** with electric power from the battery **21** to establish communication between the adapter unit and the headset. Otherwise, the adapter unit **2** cuts off electric power supply from the battery **21** to the transceiver circuit of the adapter unit **2** in order to save power consumption of the battery **21** and continues a stand-by mode. As a result, power consumption in a stand-by mode per hour can be reduced to as low as about one two hundredth (1/200) of power consumption in a communication mode per hour. Therefore, the wireless transceiver set **1** of the invention can extend the period of stand-by mode longer with such a small and light battery.

[0058] On the other hand, as for the headset **3**, the communication start and end button **3***d* can connect and disconnect the battery **31** to and from the transceiver circuit of the headset **3**. Therefore, only in a communication mode, the battery **31** supplies the transceiver circuit of the headset **3** with electric power for communication. There is no stand-by mode in the headset **3**. There are only two modes, a communication mode and a nonuse mode in the headset **3**. Although the CPU **30** is always connected to the battery **31** even in the nonuse mode, since power consumption of CPU **30** made by CMOS technology during the nonuse mode in the headset **3** is the same as or less than the leakage current of the battery **31**, the headset **3** can assure a **10** hour continuous communication time with such a small battery.

[0059] The wireless transceiver set of the invention can prevent power consumption of small battery in a stand-by mode so as to assure longer standby time and communication time.

[0060] **FIG. 5A** shows another embodiment of the invention. In this embodiment, a headset **3** put on at a user's ear is used as a child unit of a standard or stationary phone **80**. The headset **3** has an earphone (not shown) as shown in **FIG. 1** and can be put on at a user's ear with a hook (not shown). The headset **3** also has a microphone **3***c* to make a set of earphone and microphone. The headset **3** may further includes a communication start and end button **3***e* and a redial switch 3d.

[0061] **FIG. 6** shows a block diagram of the circuit included in the headset **3** to be used as a child unit of the stationary phone **80** of **FIG. 5A**. The receiver circuit of the headset **3** includes an antenna **3***a* incorporated in a hook for ear, a separation circuit **61** for connecting the receiver circuit and a transmission circuit to the antenna **3***a*, a high frequency amplifier **62** for amplifying a radio frequency **6** from the stationary phone **80** received by the antenna **3***a*, a frequency converter **64** connected to a local oscillator **63** of variable frequency PLL (phase locked loop) type for converting a received frequency, a filter **65**, an intermediate frequency amplifier **66**, a limiter **67**, a frequency demodulator **68**, a low frequency amplifier **69** for amplifying sound signal demodulated by the frequency modulator **68**, an

earphone 3*b* for outputting sound signal from the low frequency amplifier **69**, and a control circuit **70** including a CPU to which control data demodulated by the frequency demodulator **68** is supplied.

[0062] The communication start and end switch 3*e* and the redial switch 3*d* are connected to the control circuit **70** which controls communication between the headset **3** and the stationary phone **80**. For example, the control circuit **70** sends and receives data for determining the transmission and receiving frequencies to control the radio frequencies **6** and **7** through the local oscillators **63** and **73**, informs a ring indicating an incoming call, and controls on and off conditions of the communication start and end button 3*e* and of the redial button 3*d* in the headset **3**. A power supply control circuit **71** for controlling electric power supply from a battery **31** to all circuits in the headset **3** is connected to the control circuit **70** in order to save power consumption. For example, the control circuit **70** periodically controls power supply to the receiver circuit of the headset **3** to save power consumption of the battery **31**. The transmitter circuit of the headset **3** includes a microphone 3*c*, a low frequency amplifier **72**, a local oscillator **73** of variable frequency PLL (phase locked loop) type, a high frequency amplifier **74**, and a power amplifier **75** for sending user's sound signal inputted from a microphone and control data from the control circuit **70** to the stationary phone **80** through a radio frequency **7** via a separator **61** and the antenna 3*a*.

[0063] **FIG. 7** shows a block diagram of circuit in the stationary phone **80** used as parent unit with the headset **3** of **FIG. 5A through a** radio frequency. The receiver circuit of the stationary phone **80** includes an antenna **80***a*, a separation circuit **81** for connecting both the receiver circuit and a transmitter circuit to the antenna **80***a*, a high frequency amplifier **82** for amplifying a radio frequency **7** from the headset **3** received by the antenna **80***a*, a frequency converter **84** connected to a local oscillator **83** of variable frequency PLL (phase locked loop) type for converting a received frequency, a filter **85**, an intermediate frequency amplifier **86**, a limiter **87**, a frequency demodulator **88**, a low frequency amplifier **89** for amplifying sound signals demodulated by the frequency modulator **88**, a hybrid circuit **89** for sending and receiving sound signals from the low frequency amplifier **89** through a telephone line **96**, a hook control circuit **98**, an incoming call detection circuit **99** and a control circuit **90** including CPU to which control data demodulated by the frequency demodulator **88** is supplied.

[0064] The telephone line **96** may be in parallel with a telephone line connecting to the stationary phone **80**. The circuit shown in **FIG. 7** may not have dialing function for connection but only receiving function for receiving incoming calls. Dialing function in the stationary phone **80** may be used, instead. The control circuit **90** of **FIG. 7** may have only redial function connecting to the dial number of the latest call only when the redial button 3*d* of the headset **3** of **FIG. 6** is pushed. In addition, the control circuit **90** deals with an incoming call detection from the telephone line **96**, hook control, various control data including control data generated by buttons 3*e* and 3*d* of the headset **3**, frequency control of transmitting and receiving radio frequencies **6** and **7**, and etc. The transmitter circuit of the stationary phone **80** includes an incoming call detection circuit **99** connected to the telephone line **96**, a hook control circuit **98**, a low frequency amplifier **72** connecting through a hybrid circuit **97**, a local oscillator **93** of variable frequency PLL (phase locked loop) type, a high frequency amplifier **94**, and a power amplifier **95** for sending sound signal inputted from the telephone line **96** and control data from the control circuit **90** through a radio frequency **6** via a separator **81** and the antenna **80***a* to the headset **3**.

[0065] According to the embodiment shown in **FIGS. 5A, 6** and **7**, a user can talk over the headset **3** put on at a user's ear by pushing a button 3*e* through radio frequencies **6** and **7** sent to and received from the stationary phone **80** connected to the telephone line **96**. A user can talk over the headset **3** with hand-free condition and walk around within the range where the radio frequencies **6** and **7** can reach. If a user pushes the redial button 3*d* of the headset **3**, user can redial the number of the latest call through the stationary phone **80**.

[0066] **FIG. 5B** shows another embodiment of the present invention. **FIG. 5B** shows a personal digital assistance (PDA) **50** in which a cellular phone, cordless digital phone or an internal modem is incorporated in order to connect to a telephone line. The PDA **50** includes the transceiver circuit as shown in **FIG. 3** or the transceiver circuit as shown in **FIG. 7** to send and receive radio frequencies **6** and **7** through an antenna **50***a* to and from a headset **3**. The headset **3** includes the transceiver circuit as shown in **FIG. 6**. According to this embodiment, user can put on the headset **3** on his/her ear to talk over the headset **3** through the PDA **50** or to have access to the Internet through the PDA **50**.

1. A wireless transceiver set including an adapter unit adapted to be connected to a cellular phone and a headset adapted to be put on at a user's head portion, comprising:

said adapter unit including a first CPU, a first battery, a first transceiver means for sending and receiving sound and control signals from and to the adapter unit through a radio frequency, a detection means for periodically detecting a radio frequency from the headset, and a first power switching means for supplying the adapter unit with electric power from the first battery when the detection means detects the radio frequency from the headset and for cutting off the electric power from the first battery when the detection means does not detect any radio frequency from the had set, and

said headset including a second CPU, a second battery, a second transceiver means for sending and receiving sound and control signals from and to the headset through a radio frequency, and a second power switching means for supplying the headset with electric power from the second battery and for cutting off the electric power from the second battery in order to start and end communication through the adapter unit.

2. The wireless transceiver set of claim 1, wherein said detection means detect a radio frequency from the headset every a few seconds.

3. The wireless transceiver set of claim 1, wherein said first and second batteries are batteries of button type.

4. The wireless transceiver set of claim 1, wherein said first and second batteries are rechargeable.

5. The wireless transceiver set of claim 1, wherein said first CPU converts protocols between control data of the cellular phone and the wireless transceiver set.

6. A child unit of a stationary phone adapted to communicate over the stationary phone through a radio frequency, comprising:

a headset adapted to be put on at a user's ear and including a microphone, an earphone, a battery therein, a transceiver means for sending and receiving sound signals to and from the stationary phone through a radio frequency, and a switch means for switching on and off electric power supply to the transceiver means from the battery in order to start or end communication over the stationary phone.

7. A wireless transceiver set for a personal digital assistance (PDA) to communicate over the personal digital assistance through a radio frequency, comprising:

a headset adapted to be put on at a user's ear and including a microphone, an earphone, a battery therein, a transceiver means for sending and receiving sound signal through a radio frequency, and a switch means for switching on and off electric power supply to the transceiver means from the battery in order to start or end communication over the personal digital assistance.

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